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Indian Standard

SPECIFICATION FOR DRILL PIPES FOR USE IN OIL OR NATURAL GAS WELLS

UDC 621·643·2 : 622·24

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 1

January 1973

AMENDMENT NO. 1 JULY 1983

TO

IS:6647-1972 SPECIFICATION FOR DRILL PIPES FOR USE IN OIL OR NATURAL GAS WELLS

Alterations

(*Page 4, clause 5.1*) - Substitute the following for the existing clause:

'5.1 When requested by the purchaser, the manufacturer shall furnish a report giving the ladle analysis of each heat of steel.

5.1.1 The steel shall not have more than 0.06 percent of sulphur and 0.04 percent of phosphorus.

5.1.2 The analysis of steel shall be carried out either by the method specified in IS:228 Methods for chemical analysis of steels and its relevant parts or any other established instrumental/chemical method. In case of dispute the procedure given in IS:228 and its relevant parts shall be referee method. However, where the method is not given in IS:228 and its relevant parts, the referee method shall be agreed to between the purchaser and the manufacturer.'

(*Page 4, foot-note with '*' mark*) - Delete.

(SMDC 22)

Reprography Unit, ISI, New Delhi, India

Indian Standard

SPECIFICATION FOR DRILL PIPES FOR USE IN OIL OR NATURAL GAS WELLS

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AMENDMENT NO. 1 JULY 1983

TO

IS:6647-1972 SPECIFICATION FOR DRILL PIPES FOR USE IN OIL OR NATURAL GAS WELLS

Alterations

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Indian Standard
SPECIFICATION FOR DRILL PIPES FOR USE IN OIL OR NATURAL GAS WELLS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 12 October 1972, after the draft finalized by the Steel Tubes, Pipes and Fittings Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 Keeping in view the manufacturing and trade practices followed in the country, this standard has been prepared to meet the increased application of drill pipes. In preparing this standard, assistance has been derived from the following:

ISO/TC 67 (SC 5-1) 44 E Draft Proposal for casing, tubing and drill pipes. International Organization for Standardization.

API Std 5 A: 1970 Specification for casing, tubing and drill pipes. American Petroleum Institute.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded of in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers the requirements for seamless drill pipes for use in oil or natural gas wells.

2. SUPPLY OF MATERIAL

2.1 General requirements relating to the supply of drill pipes shall conform to IS : 1387-1967†.

3. GRADES

3.1 Drill pipes shall be of two grades depending on the minimum yield strength, namely, YSt 379 and YSt 517.

---

*Rules for rounding off numerical values (*revised*).

†General requirements for the supply of metallurgical materials (*first revision*).

4. MANUFACTURE

4.1 Steel for drill pipes shall be manufactured by open hearth, electric, basic oxygen or a combination of these processes. In case any other process is employed by the manufacturer, prior approval of the purchaser should be obtained. If the basic oxygen process is employed for manufacture, the nitrogen content of the steel shall not exceed 0·007 percent.

4.2 Drill pipes shall be manufactured by any one of the following processes:

a) Hot Finished Seamless (HFS), and

b) Cold Drawn Seamless (CDS).

5. CHEMICAL REQUIREMENTS

5.1 Ladle Analysis — When requested by the purchaser, the manufacturer shall furnish a report giving the ladle analysis of each heat of steel. The steel when analysed in accordance with IS : 228-1959* shall show not more than 0·06 percent of sulphur and 0·04 percent of phosphorus.

5.2 Product Analysis — Two samples shall be analysed for product analysis, one from each of the two lengths of pipe from each lot of 400 lengths or less. For multiple length seamless pipe, a length shall be considered as all of the sections cut from a particular multiple length. The samples shall be composed of cuttings or drillings representing the full wall thickness of the drill pipe taken from several points around the pipe. If drillings are used, the minimum drill size shall be 12·7 mm.

5.3 Recheck Analysis — If the product analysis of both lengths of pipe representing the lot fails to conform to the specified requirements, at the manufacturer's option, either the lot shall stand rejected or all the remaining lengths in the lot shall be tested individually for conforming to the specified requirements of the product analysis. If only one of the two samples fails, at the manufacturer's option, either the lot shall stand rejected or two recheck analyses shall be made on two additional lengths from the same lot. If both the recheck analyses conform to the requirements, the lot shall be accepted, except for the length represented by the initial analysis which failed. If one or both of the recheck analysis fail, at the option of the manufacturer, the entire lot shall be rejected or each of the remaining lengths shall be tested individually. In the individual testing of the remaining lengths in any lot, analysis for only the rejecting element or elements need be determined. Samples for recheck analysis shall be taken in the same manner as specified for product analysis samples.

---

*Methods of chemical analysis of pig iron, cast iron and plain carbon and low-alloy steels (*revised*).

5.4 Mill Control Product Analysis — A product analysis shall be made by the manufacturer as a mill control of each heat of steel used for the production of pipe in this specification. Record of such analysis shall be available to the purchaser.

6. HEAT TREATMENT

6.1 Grade YSt 517 drill pipe shall be heat-treated full length, and if upset, shall be heat-treated full length after upsetting. Grade YSt 379 shall be normalized, if so specified by the purchaser.

7. DIMENSIONS AND WEIGHTS

7.1 Dimensions and weights of drill pipes shall conform to the requirements specified in Table 1.

7.1.1 *Weight* — Each length of drill pipe shall be weighed separately. For drill pipe with integral rotary connections or attached rotary connections, allowance for the effective connection weight shall be made. The weight determined shall conform to the specified calculated weights (or adjusted calculated weights) for the end finish specified on the purchase order, within the tolerance stipulated. Calculated weights shall be determined in accordance with the following formula:

$$W_L = W_{pe} \times L + E_W$$

where

W_L = calculated weight in kg of a piece of pipe of length L metres;

W_{pe} = plane end weight in kg/m;

L = length of pipe in metres including end finish; and

E_W = weight gained or lost in kg, due to end finishing. For plain end pipe $E_W = 0$.

7.1.2 *Length* — Pipes shall be furnished in the range of lengths given in Table 2. The lengths as defined here are measured as the overall length of the drill pipes including upset ends for welding.

8. TOLERANCES

8.1 The following tolerances on outside diameter, wall thickness and weight shall apply:

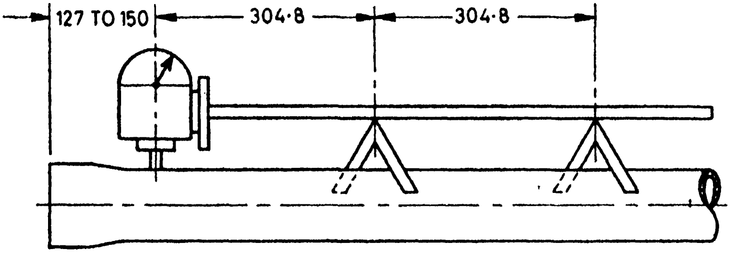
Outside diameter	± 0·75 percent
Wall thickness	− 12·5 percent
Weight:	
Single length	+ 6·5 percent − 3·5 percent
Carload lots (18 144 kg)	− 1·75 percent

8.2 Inside diameter is governed by the outside diameter and weight tolerances.

8.3 Eccentricity

8.3.1 The maximum eccentricity as measured with a sadle gauge (*see* Fig. 1) at a distance of 127 to 150 mm from the upset and shall not exceed 2·4 mm (total reading of the measuring instrument).

8.3.2 The maximum eccentricity of the bore of the upset outside surface of the drill pipe shall not be more than 1·587 mm (3·175 total indicator reading).



All dimensions in millimetres.

Fig. 1 Sadle Gauge for Measuring Eccentricity of Drill Pipe

8.4 Ovality — The maximum ovality as measured with a micrometer on the external upset diameter shall not exceed 2·4 mm.

8.5 Drift Test — Each length of external upset drill pipe except 88·9 mm OD × 9·35 mm thick, shall be tested throughout the length of the end upset with a drift mandrel having a diameter 4·76 mm smaller than the inside diameter of the pipe as given in Table 1 and a length of 101·6 mm.

8.6 Length — The tolerance on length of pipe shall be as given in Table 2.

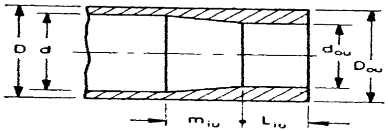
8.7 Straightness — The pipes shall be furnished with a reasonable straightness.

9. WORKMANSHIP AND FINISH

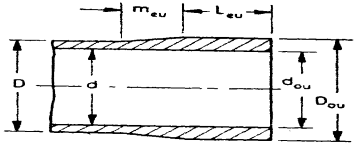
9.1 Drill pipes shall be furnished with upset ends for attachment of rotary connections by welding, except that drill pipes shall be furnished with end finished, other than specified herein, when so agreed to by the purchaser and the manufacturer in which case all stipulations herein other than end finish and calculated weights shall govern.

TABLE 1 DIMENSIONS FOR UPSET DRILL PIPES

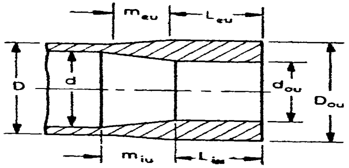
(*Clauses* 7.1 *and* 8.5)



Internal Upset



External Upset



Internal-External Upset

OUTSIDE DIAMETER D	NOMINAL WEIGHT*	WALL THICKNESS t	INSIDE DIAMETER d	CALCULATED WEIGHT		OUTSIDE DIAMETER‡ $D_{ou}{}^{+3\cdot18}_{-0\cdot79}$	INSIDE DIA AT END OF PIPE§ $d_{ou}\pm1\cdot59$	UPSET DIMENSIONS IN mm‖					
				Plain End	Upset† End			Length of Internal Upset $L_{iu}{}^{+38\cdot10}_{-12\cdot70}$	Length of Internal Taper, *Min* m_{iu}	Length of External Upset, *Min* L_{eu}	Length of External Taper *Min*	Length of External Taper *Max*	Length End of Pipe to Taper Fade-out, *Max* $L_{eu}+m_{eu}$
mm	kg/m	mm	mm	kg/m	kg	mm	mm	mm	mm	mm	mm	mm	mm
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
				Internal Upset Drill Pipe									
73·0	10·2	5·51	62·0	9·18	1·27	73·0	47·6	44·4	—	—	—	—	—
73·0	15·5	9·19	54·6	14·48	1·45	73·0	33·3	44·4	33·1	—	—	—	—
88·9	14·1	6·45	76·0	13·12	2·00	83·9	57·2	44·4	—	—	—	—	—
88·9	19·8	9·35	70·2	18·34	2·00	83·9	49·2	44·4	38·1	—	—	—	—
88·9	23·1	11·40	66·1	21·79	1·54	88·9	49·2	44·4	33·1	—	—	—	—
101·6	17·6	6·65	88·3	15·58	1·91	101·6	74·6	44·4	—	—	—	—	—
101·6	20·8	8·38	84·8	19·26	2·09	101·6	69·8	44·4	50·8	—	—	—	—
114·3	20·5	6·88	100·5	18·23	2·35	114·3	85·7	44·4	—	—	—	—	—
114·3	24·7	8·56	97·2	22·31	2·63	114·3	80·2	44·5	50·8	—	—	—	—
127·0	24·2	7·52	112·0	22·15	3·00	127·0	95·2	44·4	—	—	—	—	—
				External Upset Drill Pipe									
60·3	7·2	4·83	50·6	6·60	0·82	67·5	50·7	—	—	38·1	38·1	—	101·6
60·3	9·9	7·11	46·1	9·32	0·82	67·5	46·1	—	—	38·1	38·1	—	101·6
73·0	10·2	5·51	62·0	9·18	1·09	81·8	62·0	—	—	38·1	38·1	—	101·6
73·0	15·5	9·19	54·6	14·48	1·09	81·8	54·6	—	—	38·1	38·1	—	101·6
88·9	14·1	6·45	76·0	13·12	1·18	97·1	76·0	—	—	38·1	38·1	—	101·6
88·9	19·8	9·35	70·2	18·34	1·82	97·1	66·1	57·2	50·8	38·1	38·1	—	101·6
88·9	23·1	11·40	66·1	21·79	1·27	97·1	66·1	—	—	38·1	38·1	—	101·6
101·6	17·6	6·65	88·3	15·58	2·27	114·3	88·3	—	—	38·1	38·1	—	101·6
101·6	20·8	8·38	84·8	19·26	2·27	114·3	84·8	—	—	38·1	38·1	—	101·6
114·3	20·5	6·88	100·5	18·23	2·54	127·0	100·5	—	—	38·1	38·1	—	101·6
114·3	24·7	8·56	97·2	22·31	2·54	127·0	97·2	—	—	38·1	38·1	—	101·6
114·3	29·8	10·92	92·5	27·84	2·54	127·0	92·5	—	—	38·1	38·1	—	101·6
				Internal-External Upset Drill Pipe									
114·3	29·8	10·92	92·5	27·84	3·90	121·4	76·2	57·2	50·8	38·1	25·4	38·1	101·6
127·0	29·0	9·19	108·6	26·71	3·90	131·8	93·7	57·2	50·8	38·1	25·4	38·1	101·6
139·7	32·6	9·17	121·4	29·51	4·81	141·3	101·6	57·2	50·8	38·1	25·4	38·1	101·6
139·7	36·8	10·54	118·6	33·57	4·09	141·3	101·6	57·2	50·8	38·1	25·4	38·1	101·6

*Nominal weights are shown for the purpose of identification in ordering.

†Weight gain or loss due to end finishing (*see* **7.1.1**).

‡The ends of internal upset drill pipe shall not be smaller in outside diameter than the values shown in col 7 including the minus tolerance. They may be furnished with slight external upset within the tolerance specified.

§Maximum taper on inside diameter of internal upset and internal-external upset is 6·4 mm per 30 cm.

‖The specified upset dimensions do not necessarily agree with the bore and OD dimensions of finished weld-on assemblies. Upset dimensions were chosen to accommodate the various bores of tool joints and to maintain a satisfactory cross-section in the weld zone final machining of the assembly.

TABLE 2 RANGE LENGTHS

(*Clauses* 7.1.2 *and* 8.6)

SL No.	RANGE LENGTH	RANGE IN METRES		
		1	2	3
i)	For total car load:	5·5 to 6·5	8 to 9	11·5 to 13·5
ii)	For 95 percent or more of carload:			
	a) Permissible variation, *Max*	0·5	—	—
	b) Permissible length, *Min*	6	—	—
iii)	For 90 percent or more of carload:			
	a) Permissible variation, *Max*	—	0·6	0·9
	b) Permissible length, *Min*	—	8	11·5

9.2 Coatings — Unless otherwise agreed to, pipes shall be given a mill coating to protect them from rusting in transit.

NOTE — If bare pipe or specially coated pipe is desired, the purchase order should state accordingly. For special coatings, the purchase order should state further whether the coating is to be applied to the full length or whether a certain specified distance from the end is to be left uncoated. Unless otherwise specified, such bare ends are commonly given and coatings with oil for protection in transit.

9.3 All pipes shall be visually examined and shall be free from injurious seams and defects.

9.3.1 When the depth of defects is in excess of 12·5 percent of the tabulated wall thickness, such defects shall be considered injurious. Welding or patching of such defects is not permitted.

10. PHYSICAL TESTS

10.1 Tensile Test

10.1.1 One tensile test shall be made on a length of pipe from each lot of 400 lengths or less provided that in the case of heat-treated pipe, all the lengths in each lot shall have received the same heat treatment. For multiple length seamless pipe, a length shall be considered as all of the sections cut from a particular multiple length.

10.1.2 The yield strength, tensile strength and the percentage elongation of steel when determined in accordance with IS : 1894-1962* with the test piece given in Fig. 2, shall conform to the values given in Table 3.

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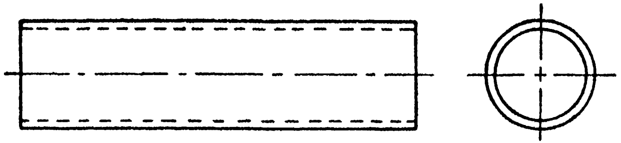
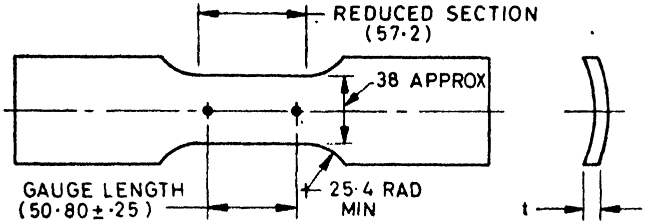
*Method for tensile testing of steel tubes.



FULL-SECTION SPECIMEN



STRIP SPECIMEN

All dimensions in millimetres.

FIG. 2 TENSILE TEST SPECIMENS

TABLE 3 TENSILE REQUIREMENTS

(*Clause* 10.1.2)

GRADE	MINIMUM TENSILE STRENGTH	MINIMUM YIELD STRENGTH	MINIMUM ELONGATION ON 50·8 mm GAUGE LENGTH
	N/mm²*	N/mm²*	Percent
YSt 379	655	379	*See* Note
YSt 517	690	517	

NOTE — The minimum elongation shall be determined by the following formula:

$$e = 2\,508 \frac{A^{0\cdot2}}{U^{0\cdot9}}$$

where

e = elongation percent,

A = cross sectional area of the tensile specimen in square millimetres, and

U = tensile strength in N/mm².

*1 kgf/mm² = 9·81 N/mm².

10.1.3 *Test Specimen* — Tensile test specimen shall be either full sections or strip specimens as shown in Fig. 2 at the option of the manufacturer. Strip specimens may be taken from any location at the option of the manufacturer. Tensile test specimens for heat-treated pipe shall receive the same treatment as finished pipes.

10.1.3.1 The width of the specimen gauge length shall be approximately 38 mm if suitable face testing grips are used or if the ends of the specimen are machined to reduce the curvature in the grip area. Otherwise, it shall be approximately 19 mm wide for pipes up to and including 88·9 mm, and 25·4 mm wide for pipes from 101·6 to 139·7 mm. In no case the specimen gauge width shall be greater than four times the thickness of the specimen.

10.1.3.2 If any tensile specimen shows defective machining or develops flaws, it should be discarded and another specimen substituted.

10.1.3.3 The test specimen shall represent the full wall thickness of the pipe from which the specimen was cut and shall be tested without flattening.

10.1.3.4 When the elongation of any tensile specimen is less than that specified, if any part of the fracture is outside the middle third of the gauge length as indicated by scribe scratches marked on the specimen before testing, a retest should be allowed.

10.2 FLATTENING TEST

10.2.1 Flattening test shall be carried out in accordance with IS : 2328-1963*.

10.2.2 The number of specimens to be taken for the flattening test shall be as follows:

Type	*Number of Tests*
Non-upset or non-heat-treated pipes	On each end of each pipe (in the case of seamless pipes, in multiple length cut in sections tests shall be made at each end of the multiple length).
Upset and heat-treated pipes	Tests specimens shall be taken at each end of each pipe before upsetting and heat treatment or on pipes at the rate of one per 20 lengths before treatment. In this case, specimens should be treated in a similar way to that specified for the grade concerned.

10.2.3 The test specimen shall be flattened between parallel plates with the specimen held in any position at the discretion of the inspector. No cracks or breaks shall occur anywhere in the specimen until the distance between plates is less than that specified below:

Grades	$D \geqq 13 \times e$	$D < 13 \times e$
YSt 379 YSt 517	$0{\cdot}7 \times D$	$\left(0{\cdot}965 - \frac{0{\cdot}020\,6 \times D}{e}\right) \times D$

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*Method for flattening test on steel tubes.

where

D = outside diameter in mm, and

e = thickness in mm.

10.3 RETESTS

10.3.1 If the tensile test specimen representing a lot of pipes fails to conform to the specified requirements, the manufacturer may elect to make retests on two additional lengths from the same lot. If both of the retests specimens conform to the requirements the lot shall be accepted, except the length from which the initial specimen was taken. If one or both of the retest specimens fail to conform to the specified requirements, the manufacturer may elect to test individually the remaining lengths in the lot in which case determinations are required only for the particular requirements with which the specimen failed to comply in the preceding test. Specimens shall be taken in the same manner as specified in **10.1.**

10.3.2 If either test specimen in the case of flattening test representing a single length of pipe or a multiple length of seamless pipe fails to meet the requirements specified, the manufacturer may elect to make additional tests on specimens cut from the same end of the same length of pipe until the requirements are met, except that the finished pipe shall not be shorter than 80 percent of its length after initial cropping. If any test specimen from a length of pipe representing a lot fails to conform to the requirements specified, the manufacturer may elect to repeat the test on specimen cut from two additional lengths of pipe from the same lot. If such specimens conform to the specified requirements, all the lengths in the lot shall be accepted, except the length initially selected for the test. If any of the retest specimens fails to face the specified requirements, the manufacturer may elect to test the specimens cut from the individual lengths remaining in the lot. Specimens for retests shall be taken in the same manner as specified in **10.2.** At the option of the manufacturer any lot of heat-treated pipes may be reheat-treated and retested.

11. THREAD PROTECTORS

11.1 Thread protectors to prevent damage to pipe end and threads shall be applied as agreed to between the purchaser and the manufacturer.

12. MARKING

12.1 The pipes shall be marked with the particulars given in **12.2** and **12.3.**

12.2 Die-stamped Markings — Die-stamped markings shall be placed on each length of pipe on the upset portion of either end. In the case of non-upset pipe, the markings shall be placed within 200 to 300 mm from either end. Die-stamped markings shall be placed on the outside surface or if so agreed upon between the purchaser and the manufacturer, on the inside surface with location at the option of the manufacturer. Die-stamping shall be done with stamps having a blunt or rounded edge to minimize the possibility of stress concentration. The size of die-stamped markings shall be 6·35 mm. The sequence of die-stamped marking shall be as follows:

a) Manufacturer's name or trade-mark,

b) Weight per metre,

c) Grade of pipe,

d) Process of manufacture, and

e) Type of steel.

12.2.1 The following symbols may be used for indicating the type of steel:

Electric furnace steel	*E*
Open hearth steel	*R*
Basic oxygen steel	*BO*

12.2.1.1 Suitable symbols may be used for steel made by other approved processes.

12.3 Paint-stencilled Markings — Paint-stencilled markings shall be placed on the outside surface of each length of pipe or if so agreed to between the manufacturer and the purchaser on the inside surface with location and sequence of the markings at the option of the manufacturer. If placed on the outside surface, the markings, except the length marking, shall start approximately 300 mm from the end of the pipe and the individual markings shall be separated by dashes or adequate spaces. The length of marking shall be applied at a location convenient to the manufacturer, but starting within 600 mm of the end of the pipe. The sequence of marking shall be as shown below:

a) Size,

b) Weight per metre,

c) Grade of pipe,

d) Process of manufacture,

e) Type of steel,

f) Length in metres, and

g) Total weight in kg.

12.4 The pipes may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions, under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

INDIAN STANDARDS
ON
STEEL TUBES, PIPES AND FITTINGS

IS:	
1161-1968	Steel tubes for structural purposes (*second revision*)
1239 (Part I)-1968	Mild steel tubes, tubulars and other wrought steel fittings: **Part I Mild** steel tubes (*second revision*)
1239 (Part II)-1969	Mild steel tubes, tubulars and other wrought steel fittings: **Part II** Mild steel tubulars and others wrought steel pipe fittings (*second revision*)
1914-1961	Carbon steel boiler tubes and superheater tubes
1978-1971	Line pipe (*first revision*)
1979-1971	High test line pipe (*first revision*)
2039-1964	Steel tubes for bicycle and allied purposes
2416-1963	Boiler and superheater tubes for marine and naval purposes
2484-1964	Dimensions for steel tubes for bicycle purposes
3074-1965	Steel tubes for automotive purposes
3589-1966	Electrically welded steel pipes for water, gas and sewage (**200 to 2 000 mm** nominal diameter)
3601-1966	Steel tubes for mechanical and general engineering purposes
3609-1966	Chrome molybdenum steel, seamless, boiler and superheater tubes
4270-1967	Steel tubes used for water wells
4310-1967	lable steel pipe fittings for marine purposes
4516-1968	ptical mild steel tubes
4712-1968	Dimensions for forged steel socket-welding fittings
4740-1968	Code of practice for packaging of steel tubes
4922-1968	Seamless steel tubes (suitable for welding) for aircraft purposes
4923-1968	Hollow steel sections for structural use
5429-1969	Dimensions for steel tubes for automotive purposes
5433-1969	Oil well steel casing pipes and couplings
5504-1969	Spiral welded pipes
5929-1970	Inspection and testing procedure for circular steel tubes for aircraft purposes
6011-1970	Carbon steel tubes for use on board ships for pressure services
6286-1971	Seamless and welded steel pipe for sub-zero temperature service
6392-1972	Steel pipe flanges

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